EXHIBIT 16

...se of the consistency of the program interface. An initial letter P is reserved for these commands.

The highly automated control of large networks is not, however, the sole aim of development and the task of the administration; it is equally important to simplify the operation of small teleprocessing systems or subsystems so as to make it self-evident, obviating the need for any special training. The TRANSDATA administration offers its full range of functions, together with the convenience of its interfaces, even in the smallest of configurations – further proof of the superiority of this universal concept.

Summary

The operation of a teleprocessing system requires powerful tools for the activation, monitoring and control of the communication system as well as for error diagnosis and program management. For these tasks the TRANSDATA system offers a convenient administration. Its many, in part automatic, functions make a central management of very large and complex networks possible. As a standard, network-wide capability of TRANSDATA these functions are also available to the same degree in small networks or subnetworks. On account of the consistency of its structure and protocols, the administration's capabilities are independent of the network configuration as well as of the operating system and the resources of the individual computer.

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[1] Jilek, P.: The Concept of Administration in TRANSDATA. Part 1: Principles and Practices of Administration. telcom report 1 (1978), English edition, pp. 136 to 141

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Eberhard Hennig

Electronic Image Processing in Reprotechnology

Data processing proved itself useful at an early stage for the evaluation of aerial and satellite pictures. For example, by comparing and linking information on different spectral areas and by using false color and pseudo-color techniques, it can help reveal details in pictures that would otherwise remain concealed. Barely discernible contours are intensified by computer processes and thereby made visible. Also in medicine, e.g. in microscopic optics and in the evaluation of X-ray pictures where the problems are similar, the scope for electronic picture evaluation is just as great. Price developments in the field of hardware components such as computers and mass storage media have favored such applications, and have created the necessary conditions for the introduction of image data processing into graphic reproduction techniques as a preliminary to form preparation and the printing process.

Problems in conventional reprotechnology

A series of working steps are involved before the final print (e.g. an editorial page or full-page magazine advertisement) is ready. The first step is the production of *color separations* in the final size of the colored copy.

This is generally done using electronic color-separating scanners which are increasingly being used instead of the conventional photomechanical correction methods. The next stage is *page make-up* involving, in the most straightforward cases, the stripping-in of illustrations and text according to a layout. This process is manual and can be extremely time-consuming if complicated pages have to be made up, as in some cases colored backgrounds have to be artificially created or illustrations need to be color-framed. A more complex and more frequent process is the superimposition of a foreground picture onto a background picture, for which masking films with precisely defined contours are required. This involves a considerable cost factor because of the large number of film intermediates needed to compose a page. During color composition four final-page films are required for each of the colors yellow, magenta, cyan and black, the components of which must be set accurately in register.

Page make-up is followed by the *preparation of forms* for the printing method being employed. In offset printing, screened final films are used, of which several are contact-printed onto the offset printing plate. By way of contrast, the preparation of gravure cylinders generally requires continuous-tone separation positives, irrespective of whether etching or modern electromechanical engraving techniques are employed.

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Dr.-Ing. Rudolf Hell GmbH, Kiel

Tracing the course of developments in reproduction techniques over the past few years, the greatest problem to be overcome has been that of color separation with color correction. Here the electronic color scanner has really come into its own. With the CHROMACOM® image processing system, newly developed by Dr.-Ing. Rudolf Hell GmbH, a significant contribution has been made to solving the perennial problems of full-page make-up and the elimination of subsequent color corrections.

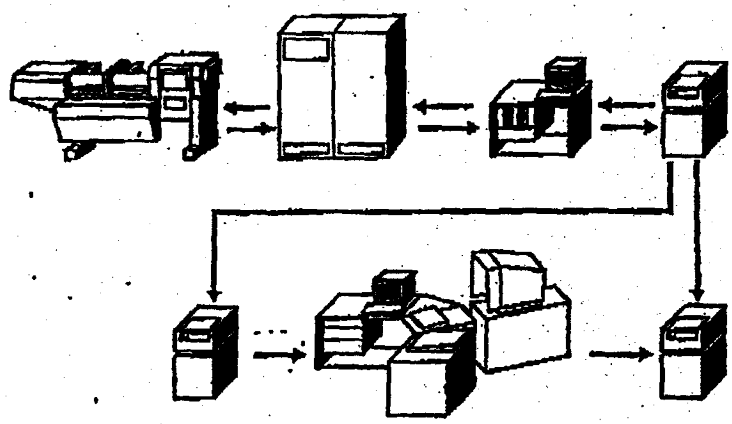

Fig. 1 CHROMACOM system with the system sections "scanning station" and "Combiskop"

The CHROMACOM system

As can be seen from Fig. 1, the CHROMACOM system is divided into two sections with off-line interaction.

The scanning station (top half of figure) consists of the DC350S® CHROMAGRAPH scanner, the control electronics, the R10 computer with two floppy-disk drives, the 3974 alphanumeric display unit and the 3948 disk drive for 300 megabyte disk packs. The two functions of the scanning station are, firstly, to supply the original data for image processing in the Combiskop by scanning the page (lower section of figure) and, secondly, to expose the color separation films using the final-page data supplied by the Combiskop.

The DC300 CHROMAGRAPH, on which the system-capable DC350S is based, is a high-performance scanner already widely used in the printing industry for producing corrected final-size color separations. In the case of this device, the original to be reproduced is placed on a rotating drum, along which the scanning head moves axially, thereby producing a helical scan of the page. The light is trapped behind a beam division and filtering system by three photomultipliers whose output signals correspond to the red, green and blue sections of the original color. A fourth multiplier generates an unsharp mask signal to enhance the detail contrast. Color and tone values are corrected in the color computer so that the signals for the corrected yellow, magenta, cyan and black separations are present at the output. After an analog/digital conversion the scale calculator, which basically consists of an image line storage, comes into operation. The image data are read in and out with variable clock frequencies, the ratio of which determines the reproduction scale with respect to the direction of the circumference of the drum. In the horizontal direction the scale is determined by the ratio of the feed rates of the scanning and recording optics. In the stand alone version of the DC300 CHROMAGRAPH the color separation films – whether electronically screened or continuous-tone positives – are simultaneously scanned and exposed.

By way of contrast, the scanning and exposure of films are separate processes in the case of the CHROMACOM system. The original data are fed to a magnetic disk (300 Mbyte) via an R10 central processing unit with disk drive. The dialog with the central processing unit (CPU) consists of details concerning the scale of the illustrations, the printing process, the screen ruling, image identifications, etc. and here the operator is computer-prompted via a 3974 alphanumeric display unit. The control program is provided by mini-floppy disks.

The density range of each color separation is defined in 256 steps, therefore 4 bytes are required to represent each color picture element. To reproduce a color picture with e.g. 60 screen dots, 120 picture elements per centimeter are required in both the horizontal and vertical directions. On the basis of these calculations the amount of data requiring processing and storage to produce one A4 page would be in the order of 35 Mbyte. Around 100 Mbyte are required to reproduce a page using unscreened continuous-tone positives.

The Combiskop (Fig. 2) carries out page make-up and correction. Here picture components, copy and colophons, etc. are set up to form a complete page and are controlled by the color monitor. The main parts of the system are:

• The R30 process control computer with disk drive and a 3974 alphanumeric display unit.

• The operating system and the programs for page make-up and picture manipulation are stored on an 80-Mbyte disk.

• A 3948 300-Mbyte drive accommodates the disk pack containing the original data acquired by the scanning station. Parameters established during image processing such as position coordinates, coloring commands, etc. are also filed on the original data disk. The subsequent computing process produces final-page data on the basis of these parameters, and these are stored in a second storage disk. This *final-page run* may also be carried out by a separate *final-page station*.

• The R30 CPU acts as the host computer in communication with the control electronics of the *video storage unit*. The unit also contains two refresh memories, the capacities of which correspond to the image content which

be represented on the color monitor, viz. 512×512 pixels to every 4 bytes (1 byte per color separation). A number of mask storages with a storage depth of 1 bit pack mask information (geometric shapes, frames, manually or electronically produced cut-out masks, etc.). The contents of the mask storages sometimes take on switching functions, ..ng the control electronics to switch the stored pictures onto the monitor in rapid succession. This enables several pictures to be superimposed with visual control.

• The color and tone values can be corrected using the appropriate table storage loads.

• X–Y coordinate acquisition is conducted by the digitizer, which features a cross-wire for inputting the layout data (e.g. positions of the corners of picture frames) into the computer with an accuracy of 0.1 mm. The cursor control simultaneously generates a cursor point or cross at the correct position on the monitor. Retouching functions can also be conducted with the aid of the cursor, which is passed several times over the picture detail requiring retouching, so that the specific target color is attained incrementally.

• A *function keyboard* is provided to activate the comprehensive mounting and manipulation programs. The input of long instruction chains to the alphanumeric display unit is usually replaced by the operation of readily recognizable mnemonically marked keys.

• Before the picture data contained in the image storage can be displayed, a digital/analog conversion must first take place. The now analog picture signals for the subtractive primary colors yellow, magenta, cyan and black are converted by the *color converter* into signals corresponding to the additive primary colors red, green and blue. The first requirement of the color reproduction on the monitor is that it should conform to a large extent with the proof or circulation run. This depends on the phosphor colors of the cathode-ray tube and their additive mixtures being suitable for the reproduction of the printing colors in all tonal values and mixtures. Secondly, the printing criteria including the method of printing (offset, photogravure), the printing colors and the type and color of the paper must be taken into account if the printed result is to bear an accurate resemblance to the monitor picture. This is also carried out by the color converter. During page make-up for e.g. an A4 page, the contents fill the entire screen. This means that owing to the limited resolution available (512×512 pixels) the partial images of the page can only be shown as "coarse image data".

Before the fine details in pictures can be inspected or retouching and similar operations can be carried out on them, the resolution must first be higher. This is achieved by assigning a TV element to each scanned picture element. This "fine data image" is greatly enlarged compared with the overall image. In addition, the picture details can, using the zoom function, be even further enlarged without any information gain occurring.

This makes it possible for e.g. contours to be redrawn more accurately. One picture element can thus be represented in the vertical and horizontal directions by two, four or eight TV elements as required.

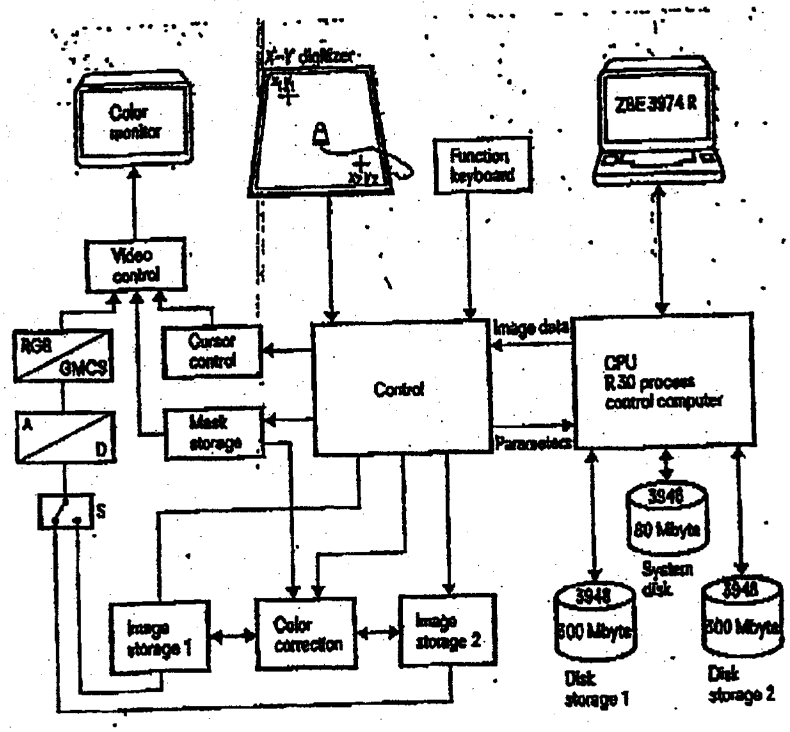

Fig. 2 Block diagram of the Combiskop conducting page make-up and correction to produce complete printed pages in color

Film exposure and form preparation

The prepared image data are availabl for exposing the color separation film after the final-page run, to which refer ence has already been made. Exposur can be carried out in the recorde section of either the DC350S CHROMAGRAPH or the CP340S large format poster scanner (forma 112 cm×127 cm), and in the case of th large formats, several color separation can be exposed one below the other.

For offset printing the color separations are screened, whilst continuous tone separation positives tend to b used for gravure.

The HELIO-KLISCHOGRAPH® is widel used today for engraving gravure cylinders. Data processing and data storag make it possible to use the image dat directly for cylinder engraving, thu dispensing with the color separations With this *HDP system* (*helio data pro*

cessing), the engraving process must be preceded by what is termed the *sorting run* in the *sorting station*, of which the *engraving data* form the end product. In producing, say, a yellow cylinder, the yellow information is extracted from the final-page data for all pages to be printed in this color and, corresponding to the cylinder layout, is distributed accurately on the engraving data disk. The same procedure is followed for the other color cylinders.

Proof recorder

As in all printing procedures, a proof is made before the circulation run so that any necessary corrections can be inserted. The stored image data are checked by a proof recorder, which provides a color proof that by and large corresponds to the final print. A color reflection material is exposed by three modulated laser beams in red, green and blue.

An R10 computer accepts the final-page data from the disk and feeds them to the color converter. The color converter then converts the colors yellow, magenta, cyan and black into three signals which activate the modulators for

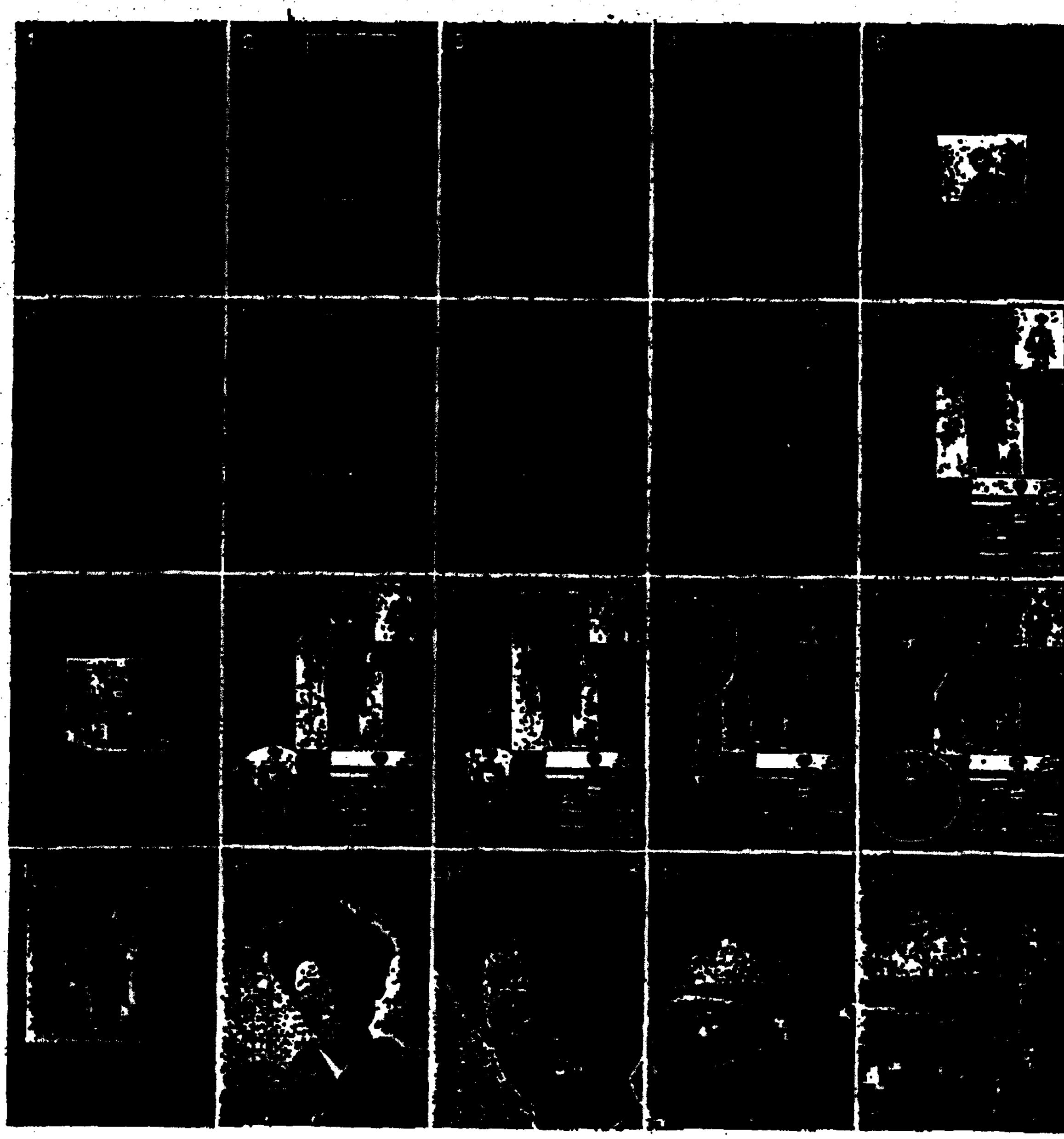

Fig. 3 An example of the page make-up process using the CHROMACOM system

component beams red, green and blue.

An example of the page make-up process

The series of color monitor photographs in Fig.3 shows some of the stages involved in developing the final page by mounting partial images and other components. The layout is secured on the digitizer layout board. The digitizer sensor and the function keyboard are then operated under monitor control to position the partial images, to generate geometric shapes, and to ink in flat areas and frames, etc.

Stage 1: The format of the final page is fixed on the digitizer, and initially appears as a blank area on the monitor. The design specifies that the background should feature a color running across the diagonal. This is achieved by tracing the corners of the picture with the cursor and by inputting the specified color values.

Stage 2: By accepting the coordinates of two diagonally opposite corners of the picture and inputting a "form rectangle" command, the rectangle stored in the mask storage is portrayed on the monitor.

Stage 3: This rectangle is then initially filled in so that a continuous mask signal – in this case a violet mask color – is available, which erases the contents of the image storage at this point.

Stage 4: The black area indicates that the background information within the "image window" has been erased.

Stage 5: The picture component intended for this image window is called down, fed into the second image storage and is moved into the correct position by following the path of the digitizer sensor.

Stage 6: The image is fixed in this position.

Stage 7: The partial image is provided with a frame in the width and color specified in the layout.

Stage 8: Another image window is formed in the same way in the top right-hand corner and the appropriate partial image is positioned.

Stage 9: In a series of further working steps three other partial images are added and a common picture frame is formed.

Stage 10: In accordance with the layout, the corners of the bottommost partial image are rounded off by inputting the specified radii of curvature.

Stage 11: The next step involves placing a partial image within a circular area. The circle is formed at the prescribed place by tracing the center of the circle and a point on its circumference with the digitizer sensor.

Stage 12: The partial image is superimposed on the circular area and fixed.

Stage 13: Textual matter is stripped in.

Stage 14: A line illustration in the shape of a flower is produced manually using the digitizer sensor.

Stage 15: The line motif consists of several closed curved lines, i.e. areas for inking in different colors. Finally, a further partial image is stripped in and fixed.

Stage 16: As was the case for the previous pictures, this partial image is also a coarse data image. Its size corresponds to the final page size, and the monitor screen is filled.

Stage 17: Representation of the fine data; each picture element corresponds to one TV element.

Stage 18: A greater enlargement can be achieved by using the zoom function (double-size in this case).

Stage 19: Zoom function with fourfold enlargement.

Stage 20: Zoom function with eightfold enlargement.

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EXHIBIT 17

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The Seybold Report
on Publishing Syste[redacted]

The Hell Chromacom:
A Tool for Today, a Vision for Tomorrow

HELL IS THE LARGEST SUPPLIER of color-separation scanners. (Hell's own estimates are that it has 60%-65% of the U.S. market, and 52% of the market worldwide.) For many quality-conscious color printers these machines have become the preferred means of producing sized and screened color separations from original transparencies or color prints. In the last decade, Hell, Crosfield, and other companies began work on digital color systems which would allow manipulation and assembly of color images to be performed in between the input scanning and output writing operations of a color separation scanner.

Actually, as often happens when new technology hits an industry, the key innovator in this field has been neither of the two established firms but Scitex, an "upstart" which has entered the graphic arts industry from other fields and has brought along its own technology and insights. Both Crosfield and Hell were hard at work on development of digital color systems long before Scitex appeared on the scene. But both have clearly been influenced by what Scitex has done and by the way in which Scitex has been able to capture the imagination of the marketplace.

Scitex brought its system to market first, Crosfield, whose highly modular approach made it possible to install systems for page layout and assembly without any color preview or correction facilities, followed quickly. However, Crosfield has had difficulty getting the final pieces of its system to the field.

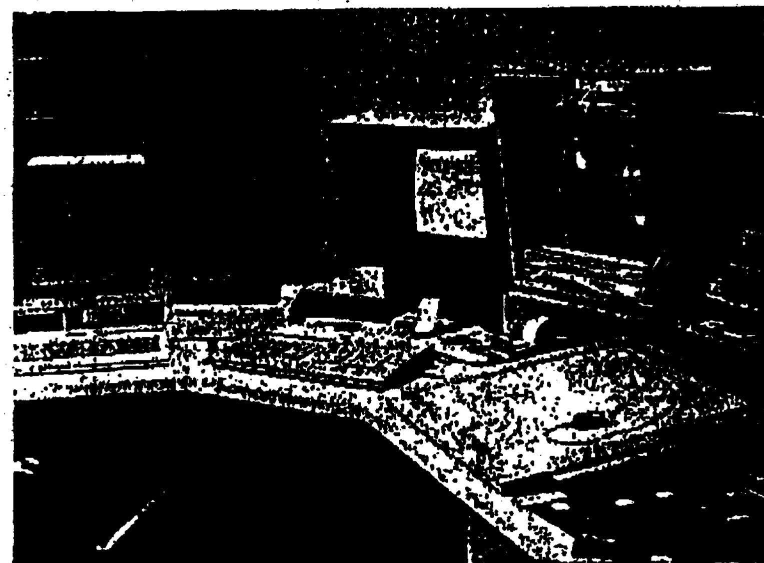
Hell, by contrast, chose to tackle a full-function system, rather than to proceed modularly. It has been building a substantial base of installations over the last two years.

In certain areas (particularly real-time image sizing and rotation and manual switching of disks) the Hell system is still somewhat less sophisticated than Scitex's. However, the system is now selling very well indeed and sales momentum is encouraged by virtue of the the large installed base of Hell scanner users. The current high value of the dollar in relation to the Deutschmark is also a positive factor. (Scitex prices are based on U.S. dollars so that exchange rates, at least in relation to the mark, are not relevant.) But beyond this, the Hell system appears to be a sensible and practical production tool.

For the future, Hell, like Scitex and Crosfield, intends to incorporate the ability to generate and output text as well as graphics. And, like Scitex, it intends to move "upstream" in the production cycle with development of a less-expensive workstation which can be used for design and page layout.

Electronic color systems have caused the blurring of the traditional craft distinctions between color separation, retouching, and stripping. In the same way, new developments in incorporating text are blurring the distinction between color operations and typesetting. The design and plate-making functions are next on the list of areas to be incorporated. We are beginning to see the emergence of total systems which will handle all pre-press functions in an electronic environment.

In our coverage of the Print '80 show at which these color systems burst onto the U.S. scene (Vol. 9, No. 16/17), we noted that they foreshadowed "the day when handling of text and graphics are far more clearly tied together than they are today." That day is dawning now.



The Combiskop, heart of the Chromacom system. *This workstation permits page assembly, retouching, color adjustment, and a variety of other operations.*

The Hell Chromocom Digital Color System

THE HELL CHROMACOM SYSTEM (marketed by HCM in North America) is a tool for the electronic assembly of full pages of color imagery. The output of the system is screened and color-separated film, ready for platemaking (or, for gravure, since a digital cylinder engraving machine may be driven directly). The key component of the Chromacom system is the Combiskop, a workstation at which scanned-in images can be assembled into pages and a wide variety of adjustments to the individual images and the page as a whole can be made.

For Hell, the Chromacom system is the latest step in an evolutionary series of products. Unlike their most important competitor in this market, Scitex, Hell has a long tradition of providing electronic products to the graphic arts industry. It is a background emphasized both by Hell and by its loyal customers.

Company history

The Chromacom system is manufactured by Dr.-Ing. Rudolf Hell GmbH in Kiel, West Germany. The company was founded in Berlin in 1929 by Rudolf Hell. Dr. Hell was 28, and he had already written a book on the infant technology of television. (Hell and his professor, Max Dieckmann, had made the first public demonstration of wireless transmission of television pictures.) Among the first products offered by the new company were facsimile machines for newspaper use. Facsimile continues to be an important Hell product area to this day. Other early product lines included radio compasses, direction finders, and Morse code recorders.

At the end of World War II, in 1945, Hell ceased operations. It was re-started two years later, in Kiel. The initial activity was repairing facsimile and Morse code recorders, but soon a variety of other tasks occupied the company: restoring the newspaper wire-service network, building a facsimile service for the Post Office, and designing a phototypesetting system. As time went on, Hell concentrated more and more on products for printing and publishing.

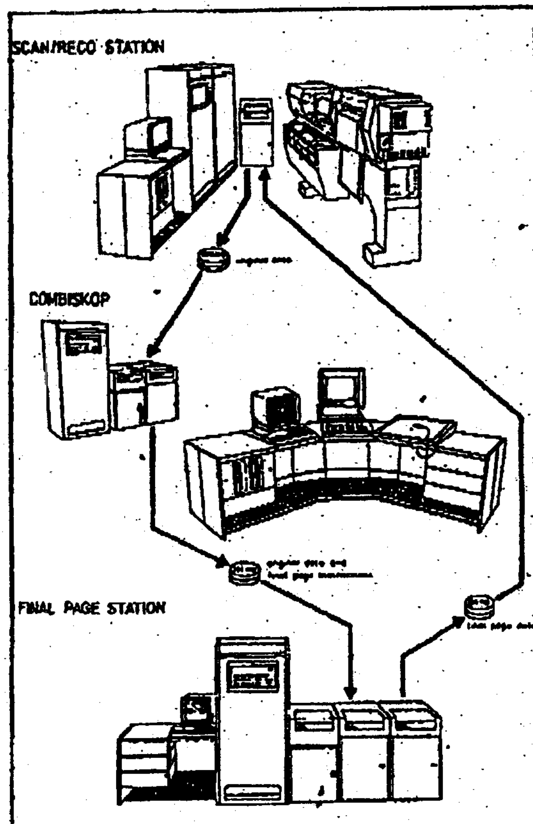
Hell's best-known products today—the line of color-separation scanners and related equipment—stem from a 1953 demonstration in which facsimile transmission was used to engrave a printing plate directly, instead of requiring photoengraving as an intermediate step. The initial product, called a "Klischograph," made raised plates for black-and-white letterpress. Color capabilities, and output suitable for offset and gravure, followed later. The direct-engraving technology led to the current "Helio-Klischograph" product, which engraves gravure cylinders directly using diamond styli under computer control. The color scanning technology led to the present "Chromagraph" family of scanners.

Hell also makes equipment for typesetting—the Hell "Digiset" systems, which were introduced in 1965. These have sold well in Europe, particularly in Germany and in Switzerland, Austria, and Yugoslavia. Digisets have been sold in the U.S. market two different times by two different companies. When the Digiset was first introduced, RCA and Siemens had a cooperative agreement (Siemens sold RCA computers under its own name in Germany). The original Hell Digiset was sold in the U.S. as the RCA VideoComp 820.[1] (RCA also sold Hell color scanners.)

More recently HCM, Hell's North American subsidiary, offered the Digiset 20T typesetter in this market. But the machine was late into the market, higher-priced than its American competitors, and did not offer a full library of U.S. type faces. It has since been withdrawn, but it continues to sell well in Europe.

Products for the printing industry dominate Hell's output. The current annual report does not give figures on prod-

[1]Eventually, the VideoComp and the Digiset evolved into completely separate product lines. Later RCA VideoComp models were hybrid machines with an RCA "front-end" (the computer/controller) and Hell "back-end" optical bed. The VideoComp product line was subsequently acquired by Information International. Since then III and Hell have proceeded on their own separate development paths. Current III VideoComps and Hell Digisets share no components in common.



Organization of Chromacom System

uct areas, but a 1979 report showed that over 80% of Hell's sales were printing-related. In 1979, 62% of sales were of scanners, engraving machines, and related equipment; and 19% were phototypesetting-related. Facsimile devices contributed 17% and textile equipment 2%.

Hell is now a wholly-owned subsidiary of Siemens AG. Siemens, the giant European electrical and electronic conglomerate, having held an 80% interest in the company, purchased the remaining 20% from Dr. Hell in 1980. (Dr. Hell, now 81, is honorary chairman of the board.) Hell's sales for 1980/81 were 395 million marks (about $186 million) with an after-tax profit of DM 22 million. Total sales for Siemens were DM 32 *billion* in 1979/80.

International scope. Hell is very much an international company, with 72% of total output being exported. About half of Hell's sales are in Europe (including Germany), approximately a quarter are in North America, and about 10% in Japan.

The Chromacom system

Although it contines to sell "straight" scanners, the key to Hell's future clearly lies with the Chromacom digital color system and its related input scanners and output recorders. The basic principles of such a system are by now familiar to most of our readers. Continuous-tone color transparencies or prints are "read" on a color-separation scanner and recorded onto disk as digitized continuous-tone (unscreened) pictures. The amounts of data thus recorded are immense: each sample point, of which there are typically 300 per inch in each dimension, is represented by 24 bits of data. This means that for each square inch of image area, there are roughly two million bits (or a quarter of a megabyte) of data. This mich data cannot be displayed and manipulated in real time with today's technology, so a coarse-resolution sampling is used for operations like color correction, image placement, and retouching, which have to be done interactively. The functions performed by the operator on the coarse data are then repeated on the full resolution data as an off-line process, called "final page processing." The final step is to record the completed page as sets of color-separated negatives. The screening is performed at this time.

The way data is transferred from one process to the next is usually by moving a disk pack from one disk drive to the next, although Hell has recently begun offering a facility which avoids the necessity of doing this.

The Combiskop

The Chromacom system has several "stations," some essential and some optional (the details are provided under "Putting together a system"), but all that is absolutely necessary is a scanning and recording station and a Combiskop station.

The Combiskop is the heart of the Chromacom system. It is the capability of the Combiskop which make it possible to do things with images which could not have been done conventionally. These facilities include page-assembly, color correction, and retouching. The Combiskop is also a key element in the cost-effectiveness of the Chromacom in use. The number of pages per hour that can be run on the Combiskop, and the number of times a given page has to be called back to the Combiskop because of revisions requested after proofing, are likely to determine whether the whole system can pay for itself or not.

Because of its importance, we will describe the operation of the Combiskop in detail.

The operator controls the Combiskop primarily using two input devices: a function box (to indicate which operation is desired) and a digitizing tablet (to indicate positions on the screen). The operator sees the effects of each operation on a video display screen. Movements of the "puck" on the digitizing tablet are reflected in cursor movements on the screen. Most operations involve a single cursor, but for some two cursors are displayed. There is also an alphanumeric VDT at the Combiskop, but this is little used. It is primarily intended for running utility programs. During Combiskop operations, the VDT displays a "job listing" of each function the operator invokes. Error messages are displayed on it.

Image size and resolution. Before describing the functions which are available on the Combiskop, a little bit of background is needed concerning how images are stored and displayed.

The screen of the Combiskop can display a maximum of 512 "pixels" (image points) in the horizontal and vertical directions. An 8" square image, at 300 dots per inch, requires 2400 pixels in each direction to be shown at full resolution. Such resolution is beyond the state of the video-display art,

so the Combiskop (or any competing product) must show either the whole image at reduced resolution or a portion of the image at full resolution.

The Combiskop offers both possibilities. It keeps each image on disk in two forms: full resolution and coarse resolution. The latter is computed from the former by taking a center-weighted average of a square block of pixels and using that average to represent the whole block when displaying the image at coarse resolution. For example, the coarse resolution image might have one pixel to represent each group of 49 pixels (*i.e.*, a 7×7 block) in the full-resolution image. In this example, the coarse-resolution image would contain roughly 2% of the number of pixels in the full-resolution version. Depending on the scanning resolution and the degree of enlargement required, the number of full-resolution pixels per coarse-resolution pixel could vary. For instance, line art is scanned at very high resolutions (up to 1800 lines per inch) so the coarse-resolution data for screen display might have only one pixel for each 20×20 block of full-resolution data.

The final size of a piece of art generally needs to be determined at input scanning time, because that is when the two disk versions are created. As will be seen, it is possible—but time-consuming—to change the size of an image at the Combiskop.

Either resolution image can be loaded into image memory and displayed on the screen. If full resolution is chosen, a 512-pixel-by-512-pixel block is loaded. Generally, this is only part of the whole image. Some operations are handled best at full resolution, and these must often be done one piece of the image at a time.

To complicate matters further, there are two other operations that affect the size of an image on the screen. One is the "zoom" feature, which causes apparent enlargement of an image by "pixel replication." This consists of copying each image pixel several times in the vertical and horizontal directions so the size of the image is increased without any new data being introduced. The available zoom factors are 2×, 4×, and 8×. The operator can apply the zoom feature to whatever is on the screen—either full- or coarse-resolution images—and the change is instantaneous. Zoom is provided for operator convenience and has no effect on the underlying image data.

The other operation affecting size is the "rotation and scale change" function. This is a function which can be used to change both the size and orientation of an image. It is relatively slow. Depending on the size of the object to be rotated, it may occupy the system for several minutes after the operator has indicated the desired size and orientation. This is the only operation which can actually change the size at which an item will be output from the size specified during scanning.

We note that Scitex now has interactive on-screen sizing and rotation facilities on its system. This is, we think, a very useful feature and one which Hell should add. To do so, Hell would need to use special-purpose hardware, designed for the task, just as Scitex does.

Image memories. The Combiskop can seem complicated at first glance. But the principles of working with it are simple. The key technical notion that is required in order to understand the Combiskop and its procedures is the idea of an "image memory." This is an area of computer memory set aside for storing pictures temporarily while they are being worked on.

For the most part, images are stored on disk. But when they are to be displayed, they are called into the image memories of the Combiskop. There are two image memories, so two different images can reside in the Combiskop at one time. The operator can select the image in either memory for display on the screen. The normal page-assembly procedure is to call each image in turn from disk into memory two; perform operations like retouching, color adjustment, and mask creation; then add it to the page which is being assembled in memory one. After the page is completed, it is written back to disk from memory one.

Masks. Although they cannot be seen in the finished page, masks are a fundamental part of color image assembly, both in conventional processes and on electronic systems like the Chromacom. Masks isolate an image area for subsequent manipulations. They can be thought of as "windows" of arbitrary shape through which a specific image can show.

For example, if the operator wants to pick up an item (a tape recorder, for instance) out of a scanned-in image and put it into a page which is being assembled, he can use a mask

The page-creation process. *This simplified demonstration page begins with a mask* **(left)** *and a page-size color vignette* **(left center)**. *A border is added, one piece of art is placed within the border, and a window for a second piece of art is created* **(right center)**. *The second piece of art is positioned in the window, completing the page* **(right)**.

which blocks out the unwanted background from the tape-recorder picture, and leaves only the recorder itself showing through. When the mask and the picture are placed together on the page the mask permits the existing page to display only to the extent that it is outside of the area occupied by the recorder. Anything which was in the area now occupied by the recorder is hidden. This is an example of what Hell calls "foreground" masking, since the mask causes the new image to be placed "on top of" the existing page.

Another type of masking, "background" masking, occurs when a mask is positioned on a page and an image is positioned behind it. For example, suppose the layout calls for the tape recorder to appear in a framed box inset into the upper left-hand corner of the page. In this case, a rectangular mask and a computer-generated frame would be created first in the proper position on the page. Then the tape recorder image would be called to the screen. The mask would function as a window through which part of the tape recorder image could be seen. Moving the image freely with the digitizer "puck," the operator would position the tape recorder within its stationary frame. No part of the page outside the frame would be affected. The new image appears to be "in back of" all the existing page elements.

A final type of masking, which is called "mixed ground," involves two masks. One mask, which is stationary, protects parts of the existing page from being covered by the new image. The other mask, which moves with the new image, causes it to cover unprotected areas of the page. Thus, as the new image is moved around the partially-assembled page, it will disappear behind some objects and hide others from view.

Creating masks. The importance of masks should be clear by now. Quite a bit of what the Combiskop operator does is related to creating and using masks.

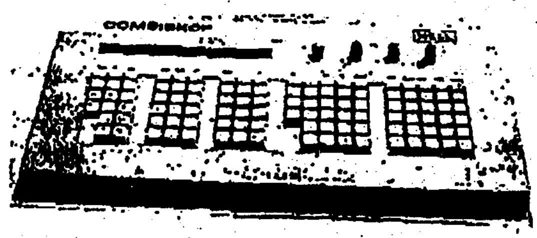
There are three ways to create masks at the Combiskop. The easiest type of mask to create is the machine-generated geometric shape. The Combiskop will automatically generate rectangles, circles, ellipses, and polygons from points input on the digitizing tablet.

If the background of an image is to be masked out, and if that background is of fairly uniform color, there is an automatic masking function which can create a mask covering all areas which are of that color (or very close to it). If the background is non-uniform, or if the image of interest contains areas of the background color, this method is less useful.

The final method of creating a mask is simply to draw it on the screen, using the digitizing tablet. This process, called "contouring" by Hell, must be done at full resolution. Buttons on the digitizer's puck permit either creation or erasing of mask areas.

After a mask has been created, it can be stored in any of seven mask memories of the Combiskop. It can also be written to disk for future use. If a mask which has been stored on disk is needed again but in a slightly different form, it can be called back to the screen for editing.

Using the Combiskop. The operator tells the Chromacom what tasks to perform via a function box which has a key for each function. The keys of the function box are in five groups. In the middle is a numeric keypad. At the left are a group which controls the cursor and digitizing tablet and a group which controls the display and placement of images and masks. At the right are a group which cause masks and frames to be generated, and a group involving generation or correction of color.



The Combiskop function keyboard. *The keys are in functional groups. The four knobs are for color adjustments. Below the word "Combiskop" is a single-line display showing the last keys pressed.*

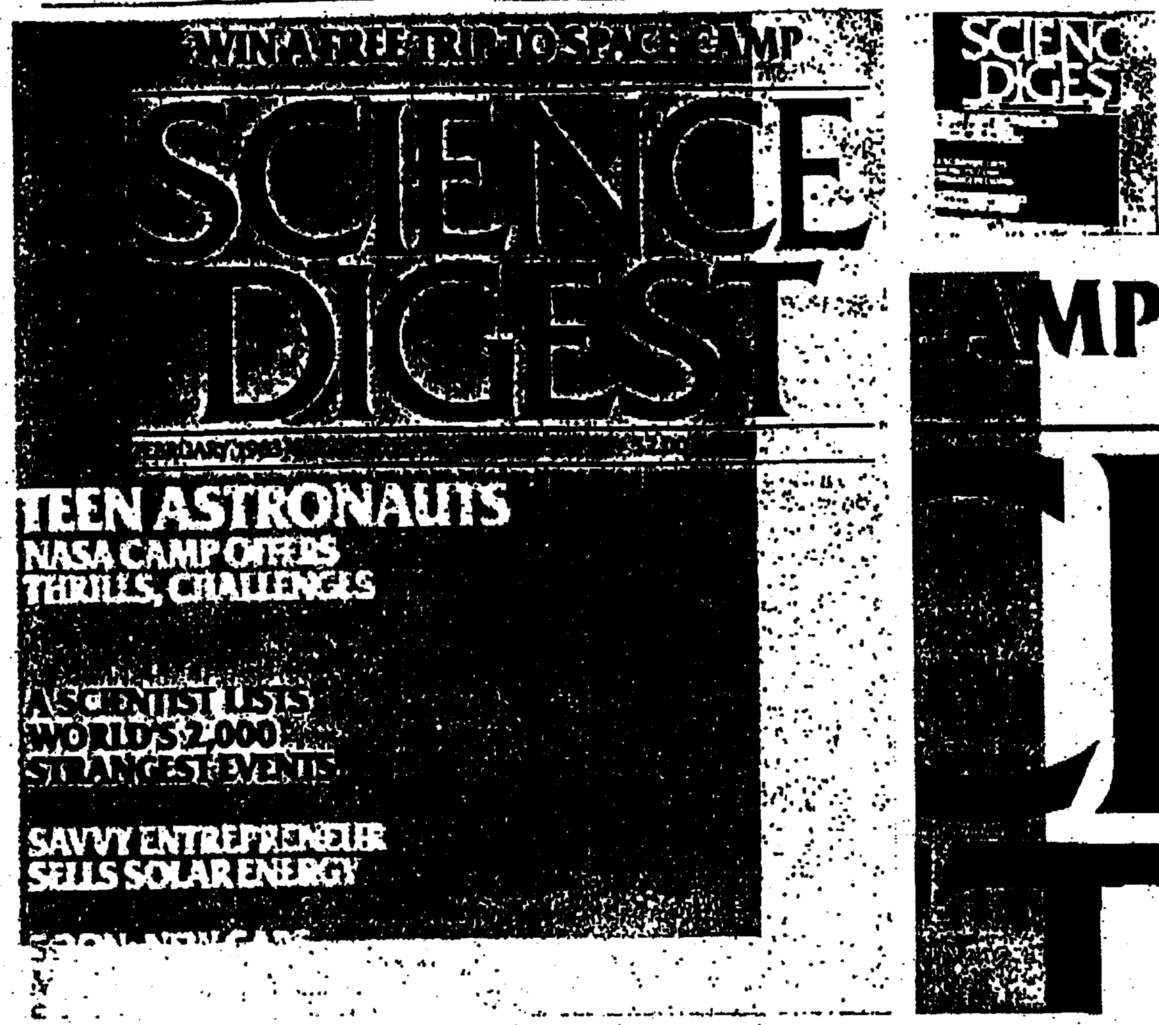
The layout of the function box is sensible and seems reasonably easy to learn in spite of the large number of keys (there are about 100 keys). It may seem like a small point, but we are surprised that Hell does not provide English-language abbreviations on the keys for systems sent to English-speaking countries. Some of the German abbreviations are close enough to the English equivalents to be useful (*e.g.*, "KEL" for "create ellipse"), but many are not ("FWD" for "define color value;" "BDM" for "rotate and scale image"). We think it would be very desirable to change these abbreviations, as well as those in the job listing *(see below)* to reflect their meanings in English.

The commands in the first function-box key grouping (cursor and digitizer commands) are basically set-up commands. They don't cause any modification of images. This group of commands includes selection of the shape and color of the cursor, the choice of which cursor to move next (when both are being displayed), and adjusting the positions of the on-screen cursor and the "puck" of the digitizing tablet so that the layout corresponds properly with the image on the screen.

The next group is the image and mask-manipulation commands. These include such things as loading images from disk (either at full or coarse resolution), loading masks from disk, positioning images and masks on the page, and changing the zoom factor. Also in this group is the auto-mask command, whose use was described earlier.

The next group of keys controls the creation of machine-generated frames and masks. Rectangular, circular, elliptical, and polygonal masks and frames can be created. Frames can be of any specified thickness and can have rounded, angled or square corners. A frame may be created so that it lies along the inside of the border of a mask, along the outside of the border, or so that it straddles the border. Also in this group are the contouring commands for drawing masks freehand. Two additional functions that are in this group are those which cause rotation and enlargement of images and masks.

The final group of functions are those concerned with color manipulation. One set of vignette-defining keys permits the operator to enter specific color values at selected points and the system generates a vignette that incorporates those colors at those points. Another set is used for retouching. The operator can select the size, shape, color, and speed of action of the electronic retouching "brush." Another set applies conventional color corrections to the highlights, middle tones, or shadows of an image. All of these functions may be



Working with scanned-in type and rules. ***Left:*** *This magazine cover demonstrates working with line art. Blocks of type were given various solid colors and vignettes.* ***Top right:*** *The job displayed on the Combiskop screen.* ***Bottom right:*** *The colored type is "spread" under the dark background, but where it emerges onto the white paper it is not. (Yellow separation negative, 200%).*

applied to the entire image, or their effect may be restricted to an area defined by a mask.

The job listing. As each function key is pressed, its abbreviation appears on the alphanumeric VDT associated with the Combiskop. There is usually not much need to refer to this "job listing" during normal operation, but it does serve an important function if the job needs to be rerun in a slightly different form at a later time, or if the operator discovers, part way through a job, that some step had been omitted earlier in the page-assembly process.

In situations like these, the job listing can be rerun, providing a kind of "instant replay" of the operations that have been done on the Combiskop. The only things which have to be re-done are those (such as retouching) which involve cursor movements during the operation. Furthermore, the job listing can be edited. This means that if two jobs differ in only a few details, the job listing from the first may be edited to produce a listing which will cause the second to be run automatically. We'll return to the job listing in describing the Layout Programmer station.

Final page processing

After all operations at the Combiskop have been completed, and before a page can be output, there is a step called "final page processing" through which the image data must pass. When a page is assembled on the Combiskop screen, most operations are carried out at coarse resolution. The full-resolution data still resides on disk in its original form. Two things have to happen before the output process can begin: all of the retouching, rotating, masking, and other image-altering steps which were done on the Combiskop have to be applied to the full-resolution data; and the various pieces of the image have to be sorted into the raster sequence in which they will be output.

This process can be lengthy. In some cases, it may even exceed the time it took the Combiskop operator to assemble

the page. This process can be done on the Combiskop, but since it involves only the minicomputer and not the operator's console, and since the Combiskop cannot be used for normal operations when it is running the final page process, it generally doesn't make sense to use the Combiskop for this process. For this reason, most Chromacom purchasers buy a "final page station"—an extra minicomputer with a pair of its own disk drives dedicated to performing just this operation.

Putting together a system

Chromacom jobs go through three major steps: input, assembly, and output. Input and output are handled by what Hell calls the "Scan/Reco" (for scanning and recording) station, and assembly is done at the Combiskop. The minimum configuration consists of just these two stations.

Scan/Reco. The Scan/Reco station can use a standard Hell scanner (the DC 350 or the large-format CP 340) for both input and output. Or one of the new output recorders *(see below)* can be used, leaving the scanner to perform input only. The DC 300B can be used as an input scanner but not as a recorder. In any case, there will be a Siemens minicomputer with an operator's VDT and at least two 300-MB disk drives. A scanner being used as a Chromacom input and output device can still be used normally as a stand-alone scanner when it is not needed for use with the system.

Combiskop. The Combiskop station consists of the Combiskop itself (including the display electronics, the digitizing tablet, and two floppy-disk drives) and a second Siemens minicomputer with VDT and 300-MB drives. At this station, there would also be an 80 MB drive for software and stored job files.

Final page station. Very few customers would choose this minimum configuration, however. There would almost always be a third minicomputer-plus-disk station at which final page processing would occur. (The alternative would be to run the final page processing on the Combiskop station, but this would make it unavailable for normal operations for periods of 15-30 minutes or more per page.)

Output recorders. Hell offers several alternative output devices for the system. The standard Hell scanners have already been mentioned. In addition, there are two output recorders and a proof-recorder. The CR 401 automatic recorder can handle film up to 21" × 29". It loads its own film, exposes it automatically, and deposits it in an output cassette or straight into a film processor. It doesn't require a darkroom. The CR 402 is a large-format recorder that can handle 44" × 50" film (the same as the CP 340 scanner). It is hand-loaded and must be operated in a darkroom.

The CR 403 proof-recorder is an interesting new product, introduced at DRUPA. It handles 21" × 29" color film or paper on which an unscreened proof can be recorded. It produces its images using two lasers. One is a Helium-Neon laser with output in the red portion of the spectrum. The other is an Argon laser with both blue and green components in its output. The blue and green portions are optically separated, making three beams in all. The three beams are independently modulated to expose the full-color image on photographic film or paper.

Layout Programmer. Another option which could speed workflow in a heavily-loaded system is the "Layout Programmer." This workstation offers the same frame and mask generating options as the Combiskop, but it doesn't handle scanned images and the various image-related functions (color-correction, airbrushing, etc.) are not available. The bulk of the work of many jobs, however, can be handled with just the functions that are available on the Layout Programmer. The Layout Programmer does not show the true colors of frames and tint areas. It can display only eight different colors. However, the operator can specify the color value that each item will have when it reaches the Combiskop.

The operations at the Layout Programmer are recorded on floppy disk as a job listing. This is subsequently "played back" on the Combiskop. At each point where the Combiskop operator needs to intervene, the job listing will include a "pause" command. The Combiskop operator can then make whatever corrections or adjustments the job calls for and resume running the job. (Further enhancements to the Layout Programmer are in the works, as described in "Plans for the Future.")

Data transfer. A high-speed magnetic tape facility (6250 bits per inch, 75 inches per second) is available for archiving and for transferring image data to other sites.

Each Chromacom "station" is essentially a stand-alone subsystem with its own minicomputer and disk drives. Within the Chromacom system, the normal way to move image data from one "station" to the next is to stop the disk drive on one station, remove the disk pack, and install it on the drive for the next station. This process is not good for disk packs or drives (both of which fare better if they are turned on and left) and it is an operational nuisance to be constantly moving disk packs around.

Hell has announced a data-switching facility which addresses this important problem. With the data-switching "network" option, a given disk drive can be connected to any of the stations without removing the disk packs. Thus, as a job moves from input scanning to Combiskop to final-page processing to output, it remains on the same disk drive but that drive is connected to each station in turn. The switching facility comes in three "levels." The minimum level provides a manually-operated switchbox which performs the switching function and nothing more. The second level provides automatic switching under the control of a minicomputer. The third level provides additional software on the switching minicomputer for such things as job tracking, cost estimation, and system-wide file management. These facilities will give Hell a file-management capability similar to Scitex's.

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2300 Kiel 14, West Germany
Telephone: (04 31) 2 00 11

flat-bed scanner. In early 1984, Hell will begin deliveries of a high-speed black-and-white flat-bed input scanner, the CN 420. This scanner can accommodate a broadsheet newspaper page (the scanning area is 19" × 23½") and is derived from Hell's products for the newspaper facsimile market. It will be able to handle both transparent and opaque originals. Resolutions up to 2500 lines per inch will be supported. At 1830 lines per inch, it can scan at a rate of 4.6 seconds per inch, which is equivalent to a broadsheet page in just over a minute and a quarter. This scanner will be useful for scanning type, line art, and pre-screened halftones.

Architecture of the Combiskop

The apparent simplicity of operation of the Combiskop belies its complex architecture. The interactivity of the display is the result of some very sophisticated image-processing that goes on continuously inside the Combiskop.

There is a Siemens minicomputer associated with the Combiskop, as there is with each station of a Chromacom installation. But the minicomputer provides very little of the processing power that is resident in the Combiskop. The main image-processing capability resides in a special-purpose display processor which Hell buys from the DeAnza division of Gould Corporation. This processor is under the control of a DEC LSI-11/23, which, in turn, is connected to the Siemens minicomputer. The 11/23 accepts data from the function box and digitizer and handles the floppy disks, as well as giving the DeAnza unit its instructions.

The DeAnza display processor's full-time function is to keep the color display running. In the process of doing this, it recomputes the color value of every one of the quarter-million pixels on the screen every thirtieth of a second. The processor gives each pixel a 24-bit value. Eight bits each are used to define the red, green, and blue components at each point. There is enough memory for two such 512-by-512-by-24-bit-deep images, plus a third temporary area of the same size used during retouching and other image alterations.

There are also eight "overlay" areas, each 512 by 512 by one bit. These are the basis for the Chromacom masks.

The image processor is constructed so that the screen is constantly refreshed by reading the entire contents of one of the image memories every thirtieth of a second. A number of processes, such as color adjustment and image shifts in the vertical and horizontal direction, can be done "on the fly" in the circuits between the image memory and the video tube. This gives the Combiskop its fluid interactivity for these processes. The "zoom" feature is also handled by this hardware, as are the two cursors.

The DeAnza processor can also produce displays from data which is partly being read from one image memory and partly from another. One of the overlay memories acts as a "switchbox" for the processor. In any position where the overlay memory contains a "one" bit, the data from one image memory is used. Positions where the overlay has a "zero" bit are read from the other memory. This feature underlies the masking capabilities of the Combiskop.

The raw processing power of the display processor is awesome. It is best appreciated by considering the difference in response times between functions like moving a picture around on the screen or changing the zoom factor (which are both instantaneous) and generating a vignette (a number of seconds) or rotating a sizable image (a number of minutes). The latter functions are done by software in the LSI-11/23, the former by the DeAnza hardware.

In fact, we think that Hell needs to push DeAnza for hardware to support real-time sizing and image rotation. This is one area where the current Scitex system offers a clear advantage over the Chromacom. Scitex's initial offering suffered from the same problem, but a hardware solution has since been found.

The Chromacom in the field

To get an understanding of what the Chromacom system means to its users, we visited two user sites. They were remarkably different in their approach to the system. One user, Kwik International in New York City, had been using the system for over two years. The emphasis at Kwik was on fast-turnaround advertising work. Kwik's history of color-separation work goes back many years before the Chromacom. Kwik has impressive facilities for all types of prepress work, both conventional and electronic. They were shown to us by Kwik's president, Dan Sirota.

The other user was Time-Life Books in Alexandria, Virginia. The system there was brand new and not yet in use for real production jobs. The system was purchased for in-house use, primarily in the production of high-quality "coffee-table" books. Time-Life Books had no prior experience with in-house color separation before purchasing the Chromacom. Tom Boynton, project manager, showed us around the carefully designed and appointed facilities.

A question we put to both Sirota and Boynton was their reason for selecting the Hell system over the competitive Scitex offering. Both men had obviously been asked the question many times before. They gave several reasons, but the most important one seemed to be the ability to get the entire package, including maintenance and support, from a single vendor. Scitex does not make an input scanner, so Scitex installations inevitably involve multi-vendor support.

Both Boynton and Sirota felt that type and line-work should normally be handled separately on film and not be run through the system. Boynton pointed out that Time-Life

Dot-etcher checking negatives. *Dot-etching is one of several labor-intensive steps which the Chromacom system bypasses. This photo was taken at Kwik International.*

books are often published in several languages, but with the same layout and pictures. If the type is on separate negatives, then only those negatives need to be re-done when a book comes out in translation. If the type were handled on the system, it would appear on the same negative with the black separation.

Sirota gave a different reason for keeping the type separate. Eighty percent of changes called for at the proof stage are changes to the text. These changes are easily handled conventionally if the type is on a separate piece of film. It would be inefficient to go back to the Combiskop to make simple wording or price changes in an ad. Sirota noted, however, that there are times when it makes very good sense to scan type and line art. This is often the case, for example, when tints or vignettes involving line work are called for. Kwik had recently taken a job which required that a black-and-white engineering drawing with lots of fine lines had to be reproduced as a color job with the lines being one tint and the background another. It would have been extremely difficult to do using conventional masking and stripping techniques, but it was easy on the Combiskop.

On the subject of cost-justification, Boynton had some very specific projections concerning the Time-Life installation. He said that the current annual cost of outside color-

(Text resumes on page 15.)

The insert which follows this page was provided by HCM to illustrate some of the capabilities of the Chromacom system.

Chromacom user list

As of this writing, the Chromacom has been installed in North America at the following thirteen sites:

Bomac-Batten
Toronto, Ontario, Canada
Gravure Systems
Florence, Kentucky
HCM Demonstration Studio
Los Angeles
HCM Demonstration Studio
New York, New York
Kwik International
New York, New York
Lehigh Electronic Color
Chicago, Illinois
Lanman Lithography
Orlando, Florida
MacLean Hunter Publications
Toronto, Ontario, Canada
Pacific Lithograph
San Francisco, California
R.R. Donnelley
Chicago, Illinois
Spectrum Incorporated
Minneapolis, Minnesota
Time-Life Books
Alexandria, Virginia
Weston Engraving
Minneapolis, Minnesota

Seven more systems have been sold, but not yet installed, in the following locations: Boston; Los Angeles (two systems); Long Island, New York; Philadelphia; Portland, Oregon; Toronto, Ontario.

In Europe, there are 53 Chromacom installations as of this writing.

Adplates Ltd.
London, England
Angsö Lito AB
Stockholm, Sweden
A/S Cliche
Oslo, Norway
Burda GmbH
Offenburg, W. Germany
Cino De Duca
Blois, France
Cino De Duca
Maison Alfort, France
Coop Offset
Montreuil, France
D. S. Colour International Ltd.
London, England
De Buck & Pavlich
Wetteren, Belgium
Graafinenstudio
Helsinki, Finland
Francois Imprimerie
Ozoir-la-Ferriere, France
Hell-Studio
Kiel, W. Germany
Hellectron f. Studio
Stockholm, Sweden
Helsingvin Kuvalaattatehdas Oy
Helsinki, Finland
HTF Scanner Team
Krefeld, W. Germany
Itee
Turin, Italy
Interrepro
Münchenstein, Switzerland
Kõhn Repro
Copenhagen, Denmark
Krammer
Linz, Austria
Kunnallispaino
Vantaa, Finland
L. Europe
Brussels, Belgium
Leleux
Brussels, Belgium
Laudert & Co.
Vreden, W. Germany
Malmö Repro-Kopia AB
Malmö, Sweden
Mayday Reproductions Ltd.
London, England
Mohndruck
Gütersloh, W. Germany
Mondadori
Verona, Italy
Neflex
Zug, Switzerland
NEFLI
Haarlem, Netherlands
Neue Chemiegraphie AG
Zürich, Switzerland
Nureg GmbH
Nuremberg, W. Germany
Oestreicher & Wagner
Munich, W. Germany
Otava
Helsinki, Finland
Pershke f. Studio
Mitcham, England
Pesavento & Co.
Zürich, Switzerland
Photomatic
Lyon, France
Profith AG
Köniz, Switzerland
Promograph S.A.
Madrid, Spain
Repro Zentrum
Klagenfurt, Austria
Reprostudy S.A.
Hosp. de Llobregat, Spain
San Paolo
Alba, Italy
Sebald Druck & Verlag
Nuremberg, W. Germany
Schaufelberger AG
Winterthur, Switzerland
Schauffler
Frankfurt, W. Germany
Schmidt
Stuttgart, W. Germany
Schmidt-Repro
Dornbirn, Austria
Siemens f. Studio
Milano, Italy
Siemens f. Studio
Paris, France
Siemens f. Studio,
Stuttgart, W. Germany
Süddeutsche Klischee-U.
Munich, W. Germany
Tesse
Brussels, Belgium
TGI
Glanerbrug, Netherlands
Time Scan
Leinfelden, W. Germany
Vau Velle Photo Litho
Leeds, England
Wirth f. Studio
Frankfurt, W. Germany
WWS Repro
Ditzingen, W. Germany
Zeno GmbH
Münster
Zilling f. Studio
Neuss, W. Germany
Zuliani S. A.
Montreux, Switzerland

In Asia, Australia, and Africa there are these installations:

Cunnan
Sydney, Australia
Hirt & Carter
Capetown, South Africa
Kaigai f. Studio
Tokyo, Japan
Koei Insatsu
Japan
Mika Seihan
Tokyo, Japan
Photra f. Studio
Johannesburg, South Africa
Scanagraphix
Melbourne, Australia
Senmeisha
Tokyo, Japan
Show Ads
Melbourne, Australia
Siemens f. Studio
Melbourne, Australia

separation services is about $3 million and that the on-going costs of the Chromacom system will be $1.2–$1.5 million per year. Boynton mentioned as important in keeping costs down the need for a single decision-maker for approval purposes. If several people are involved in the approval process, it may take many proof cycles to please them all. That would eat up most of the savings.

Sirota emphasized that Kwik had had to go through a learning process before it learned how best to make the system pay for itself. He pointed out that the learning process involved not just the system operators, but also the sales force and the company management. To make money with the Chromacom, Sirota says, "management has to know as much as the operator." Cost estimating for the system is a key area where this is true. While Kwik's sales force can make estimates for conventional jobs, all estimating for the Chromacom is still done centrally. Training the sales force on all the ins and outs of the Chromacom would simply be too hard, and there are no easy rules of thumb.

Sirota's shop is set up to make just about any type of proof a customer might want including press proofs. Boynton is standardizing on Chromalin proofs. Both men emphasized the variable nature of the printing process as limiting the value of proofs. Sirota said he had once sent out the same set of separations to five different printers, all of them highly regarded and all equipped with the proper densitometric equipment to presumably match specifications exactly. The results were surprisingly non-uniform. Boynton suggested that proofing technology was forcing printers to do a better job. He said that prior to the widespread use of proofs for on-press quality control, printers weren't required to meet objective standards. The implication was that Chromalins and similar proofs, properly made, constitute a more reliable basis for judging an image than press proofs, which may actually be less dependable in representing the final printed piece.

Operator qualifications. One of the areas of divergent opinion between Boynton and Sirota was the suitable background for potential Combiskop operators. Boynton downplayed the need for prior graphic arts experience. He said that a sense of humor was the key requirement—learning new skills and breaking in new equipment is always a trying experience and a sense of humor in important in dealing with it. Boynton's second consideration was intelligence, with graphic arts experience ranking a distant third. Boynton means what he says: one of his Combiskop operators had been a typist prior to the purchase of the system.

Boynton does not see the Combiskop as a place where color adjustments should be made (a fact that helps to explain why he feels graphic arts experience is not too important). If the scanner is set up correctly, he expects that an image can be passed through the page-assembly process and output without correction. If the proof shows a need for color adjustment, then the image can be brought back up on the Combiskop and adjusted as specified from the proof. Boynton feels that primary responsibility for color control should rest with the input scanner operator (who, Boynton feels, *must* have color separation experience) and with the quality control department.

Dan Sirota also stresses intelligence as a key trait for Combiskop operators, but he believes that a thorough grounding in graphic arts practice and the underlying theory are very important. As a result, the operators at Kwik have solid backgrounds in conventional color work.

Both Sirota and Boynton see the technology of the Chromacom system opening up new areas of endeavor. Boynton stresses cost savings. Shorter print runs will be possible because pre-press investment can be recovered on a smaller sales volume. He sees that Time-Life will be able to offer books tailored to smaller audiences. As a facetious example, he suggests the title "Plumbing for the Left-Handed."

Use for designers. Sirota emphasizes the new creative possibilities. There are many things that the Chromacom can do which would be impossible or prohibitively expensive using conventional techniques. He sees signs that ad agency art directors are beginning to plan jobs with such possibilities in mind. Some art directors who want to use the capabilities today are holding back, Sirota says. They want to have other shops to fall back on in case Kwik's system is down or overbooked when they need a job produced. Sirota is not too chagrinned at the prospect of other systems being installed in New York, since those installations mean that more art directors will feel easy about planning jobs that involve the system.

Sirota foresees a day when designers will be able to work on a system of this type. He relates the story of a clothing designer who came into the Kwik facility to check on an ad. Intrigued by the Combiskop, he asked for several changes to be made to the suit that was pictured on the display: the color was changed, the lapels were made narrower, the vest eliminated, the shoulders rounded, etc. Finally, satisfied, he announced that he was going to go back to his shop and create the suit he had just seen on the monitor.

Economics: cost-justifying the system

There seem to be two major applications for the Chromacom system. It can be viewed primarily as a way of automating conventional stripping, or it can be viewed as a device for special effects which are difficult to obtain by other methods.

If it is viewed primarily as a stripping tool, then the way to cost-justify the system is to push as many pages as possible through the system. In this case, it is important not to spend too much time on retouching, color spotting, and other niceties. With all the facilities that the system puts at the operator's disposal, it is tempting to fix up problems that would not be corrected in conventional processing. But unless such work has been allowed for in pricing the job, time spent on such activities is non-revenue-producing time.

This approach to using the system has several advantages. Jobs can be estimated and thought of by the customer and the sales force as if they were to be handled conventionally. There would be relatively little retraining involved in those areas. The sales effort could emphasize jobs with lots of pages, to keep the Chromacom system busy. Many successful Chromacom users have taken this approach.

Here is how the cost-justification might be achieved, using figures provided by HCM. Suppose a shop with a Chromacom could produce 300 pages per month at a selling price of $500 per page. This could be done with two shifts, according to HCM, providing the work is not primarily ads.

Revenues would be $150,000 per month. Against this figure must be balanced the costs. Labor would be roughly

$20,000 per month. The interest on a seven-year loan which paid for the Chromacom would also be about $20,000, and payments of principle would be another $24,000. There would be roughly $6,000 per month for the service contract. Beyond these items, which total about $70,000 per month, there would be materials, sales costs and various overheads, but it is evident that the payback could be quite attractive if these figures are realistic.

An alternative approach to using the Chromacom, and one that makes use of the real power of the system, is to concentrate on work that is difficult by conventional processes but easy on the Chromacom. In this approach, the sales force has to be taught the special advantages of the system for various types of work, and they have to seek out those jobs which are most appropriate. These will often be ads, with relatively few pages but a high price per page. Job estimating is of critical importance, since if the time required on the system is badly underestimated the job is unprofitable, and if it is badly overestimated the job may be lost to a shop using conventional processes.

The special needs of gravure

Gravure printing is a very specialized field. It is noted for its ability to produce high-quality color work without the consistency problems of offset. It is a very attractive approach to printing, except for the difficulty of the pre-press phase.

Gravure costs are dominated by the cost of preparing the huge, ungainly printing cylinders. The cost is so great that only very long press runs can be considered. Runs in the millions of impressions are common, and jobs must generally be at least in the hundreds of thousands to be economically produced by gravure. General-circulation magazines, direct-mail pieces, and Sunday newspaper magazine sections are examples of work which is often done by gravure.

Hell has been in the forefront of automating the production of gravure cylinders. The Hell Helio-Klischograph is a computer-controlled multi-headed engraving machine which engraves cells into copper-coated gravure cylinders with diamond styli. It has been widely accepted by gravure printers. Its only significant competition is the laser-engraved plastic-coated gravure cylinder developed by Crosfield. The first installation of that system is at Sun Printers in England.

Hell recently made public research work on a new engraving process which may form the basis for Hell's gravure products five or six years from now. The new method involves engraving a conventional copper cylinder with an electron beam. This exotic process must be performed in a total vacuum. The process promises two key advantages over present engraving methods: it will be an order of magnitude faster, and it will produce better-quality type and line art.

The latter advantage is due to the fact that with the electron beam, cells need not be placed precisely in a straight line (as they are with the Helio-Klischograph). The electron beam is readily deflected a small amount to either side to accommodate the needs of line art, whereas with the Helio-Klischograph, line art has to be fit to the machine's rigid raster causing the type and line art to have a slightly ragged look.

The benefits of this new technology, if it can be brought to market, will make gravure much more competitive than it is today in terms of smaller print runs and high-quality line art to match the quality of the process color.

Plans for the Future

The following statements, provided to us by HCM for this article, describe the approach Hell/HCM intends to take in developing two new capabilities: merging typeset text with graphics, and providing a pre-Combiskop page-composition station.

Text and graphics. The DC 350S and CP 340S are currently able to scan text (or any fine art) in a special high-resolution mode (six times normal). The type or line art thus scanned is then merged with the Combiskop-created geometric figures and both are processed internally at this high resolution. For users with high-volume type requirements, we will soon have a special Raster Image Processor (RIP) that will output type face image data in the standard Chromacom raster format. We will be able to interface this RIP to any front-end system, and we are making arrangements with major American vendors of digital font libraries to license their fonts to our customers. We are planning to have this product available by the middle of next year.

Pre-Combiskop station (Designer station). We are developing an extended version of the Layout Programmer Station that will be able to handle full-color images as well as geometric figures and frames. This station will work with a library of video-format pictures that have been input through a standard television camera, and the originals of the selected pictures will then be scanned in at the regular scanner. The initial hard-copy output at this station will be a monochrome representation of the composed page, which can then be used as proof-copy for approval by an art director or as a layout by the Combiskop operator. Ultimately, this station will have multiplexing and networking capabilities with the Combiskop, the Scan/Reco station, the type RIP, and with others of its own kind. We plan to release more information on this product next year.

Conclusions

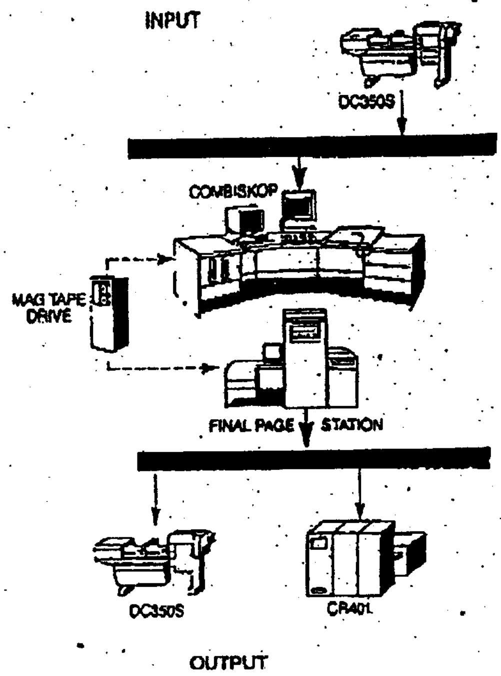
The Chromacom has, by now, proved itself a worthy contender in the color page-assembly arena. Chromacom sales are going very well at the moment (at the same time that Scitex has experienced several quarters of flat sales) and the future looks promising.

With the exception of real-time image rotation and sizing, all the basic tools are in place for efficient production, and the plans for future offerings sound appealing. We think the decision to interface to various front ends and to use fonts from various sources (instead of relying entirely on the Hell Digiset fonts, which Hell must have been sorely tempted to do) is a very good one. This will make the Chromacom attractive to a new and extensive market: potential customers with an existing investment in editing and typesetting equipment and a need for color page-assembly.

We are also attracted to the idea of the video-resolution pre-Combiskop station that Hell plans to offer. In some respects, this product sounds similar to the Scitex "Vista" console, introduced at DRUPA. But we like the Hell approach of working with full-color imagery from a television camera. This type of product could be the forerunner of workstations

Pricing

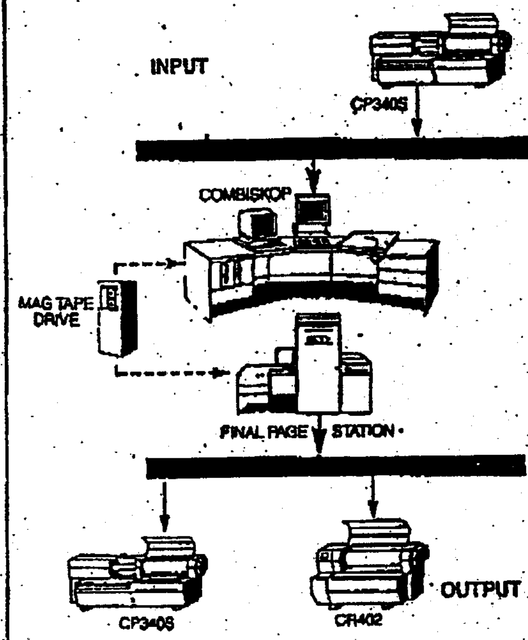
HCM provided the following pricing for two sample configurations.



Price summary: Configuration No. 1*

One DC350 L/S scan/record station	$475,500
One page make-up station	426,200
One page processing station	159,700
Subtotal	$1,061,400
One 401 recorder	$252,500
One layout programmer	68,750
Total price	$1,382,650

*Prices for both configurations include software.



Price summary: Configuration No. 2*

(1) CP 340 L/S Scan/Record Station	$549,500
(1) Page Make-Up Station	426,200
(1) Final Page Processing (Includes 1 Magnetic Tape Drive)	159,700
(4) Additional 300 Mbyte Disk Drives	76,600
Total Price	$1,212,000

Additional options include:

Proof recorder		$296,200
402		257,000
Output recorder:		
Network level I	avail. 1/Q '83	32,500
Network level II	avail. 2/3 Q '83	47,600
Network level III	avail. '84	not avail.

which are design tools, rather than production ones. Just as the newsroom terminal changed the typesetting world, bringing control into the hands of the author/editor and making production more efficient, so a design workstation could change the world of color pre-press, bringing the same kinds of control and efficiency.

In the nature of these new offerings (as well as in the willingness to announce them while they are still under development) we see signs of increasing responsiveness of Hell to the North American market. This we applaud. Hell has, at times in the past, has appeared to us unresponsive to (or unconcerned with) the particular requirements of potential customers on this side of the Atlantic, but this appears to be changing.

Hell's unique position as a vendor of both typesetting and color page-assembly systems means that as these areas merge, Hell is very well positioned to maintain a leadership role. Of the various technologies involved in getting straight to the printing plate from raw inputs, the only one Hell has no announced product for is the ability to make lithographic plates directly from Chromacom output. But Hell has shown products pointing in this direction in the context of its newspaper facsimile work, and we would expect this last capability to be added in due course.

Hell has a lot of strengths. If the company continues to listen to the needs of its customers, especially when it comes to the American market where much of the action will certainly be in the near future, it should continue to prosper. HCM is making important contributions in product definition and refinement and we expect HCM will be able to play an increasingly important role in Hell's future offerings.

George A. Alexander

CERTIFICATE OF SERVICE

I, Julia Heaney, hereby certify that on May 31, 2006, I caused to be electronically filed the foregoing with the Clerk of the Court using CM/ECF, which will send notification of such filing(s) to the following:

Paul M. Lukoff, Esquire
David E. Brand, Esquire
Prickett, Jones & Elliott, P.A.

and that I caused copies to be served upon the following in the manner indicated:

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